CONCEPT MISSION:
ALL ALTITUDE ATMOSPHERIC MONITOR (A^3M)

By

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For the

Ultra Long Duration Ballooning Technology Workshop

SDL BALLOONING TECHNOLOGY

Twenty years of balloon experience in both earth and planetary programs for NASA and DOD. Expertise includes:

- Mission profile development and sensor design
- Gondola and systems integration experience
- Gondola stabilization system sensors
- Long duration liquid and solid cryostats
- Data acquisition, compression and telemetry systems

SPACE DYNAMICS LABORATORY
Utah State University

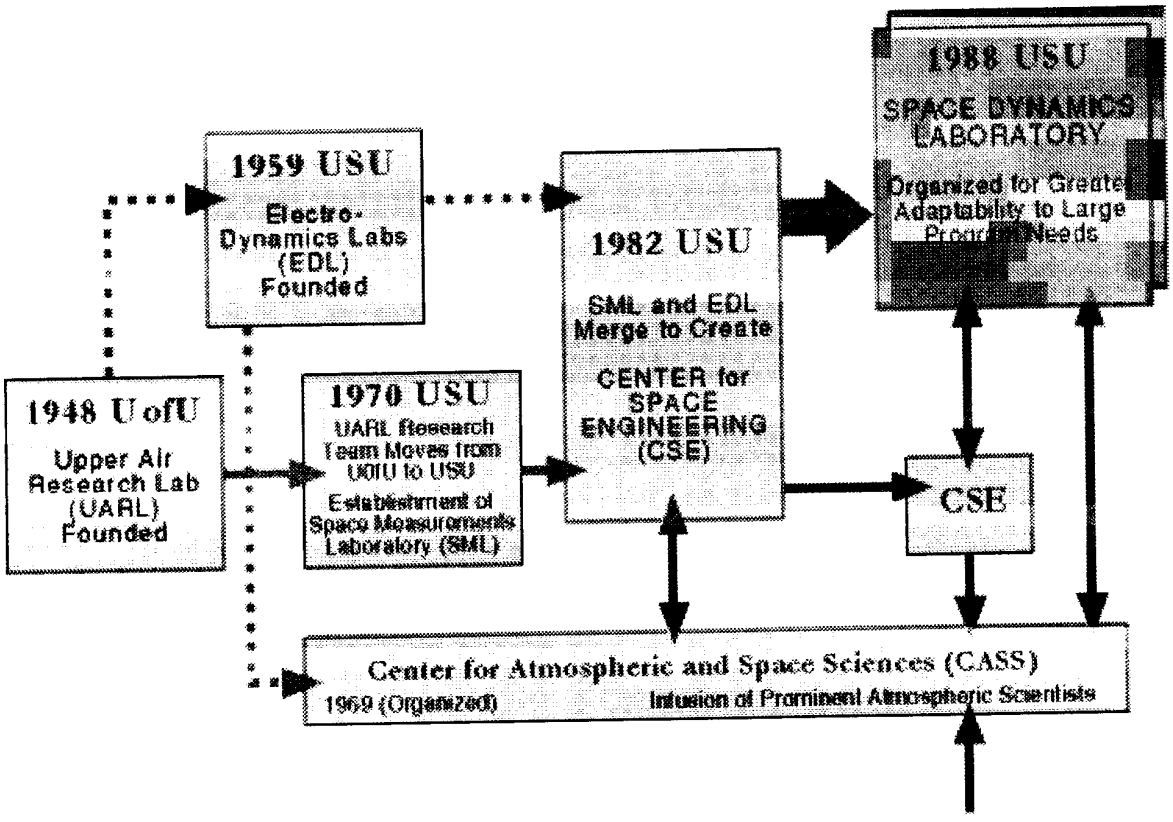
A PROFILE

PROGRAM BEGINS	1959
LOCATIONS	Logan,UT, and Bedford,MA, and Albuquerque,NM
PRESENT SIZE	Professional Staff at Logan Professional Staff at Bedford Professional Staff at Albuquerque USU Faculty Members USU Undergraduate and Graduate Students
TOTAL	328
MAJOR FUNDING	Ballistic Missile Organization (BMDO) National Aeronautics and Space Administration (NASA) USAF Phillips Laboratory (PL) Defense Nuclear Agency (DNA) Office of Naval Research (ONR) Air Force Office of Scientific Research (AFOSR) National Science Foundation (NSF) Industry
ANNUAL EXPENDITURES	$25-$40 million

SPACE DYNAMICS LABORATORY
Utah State University

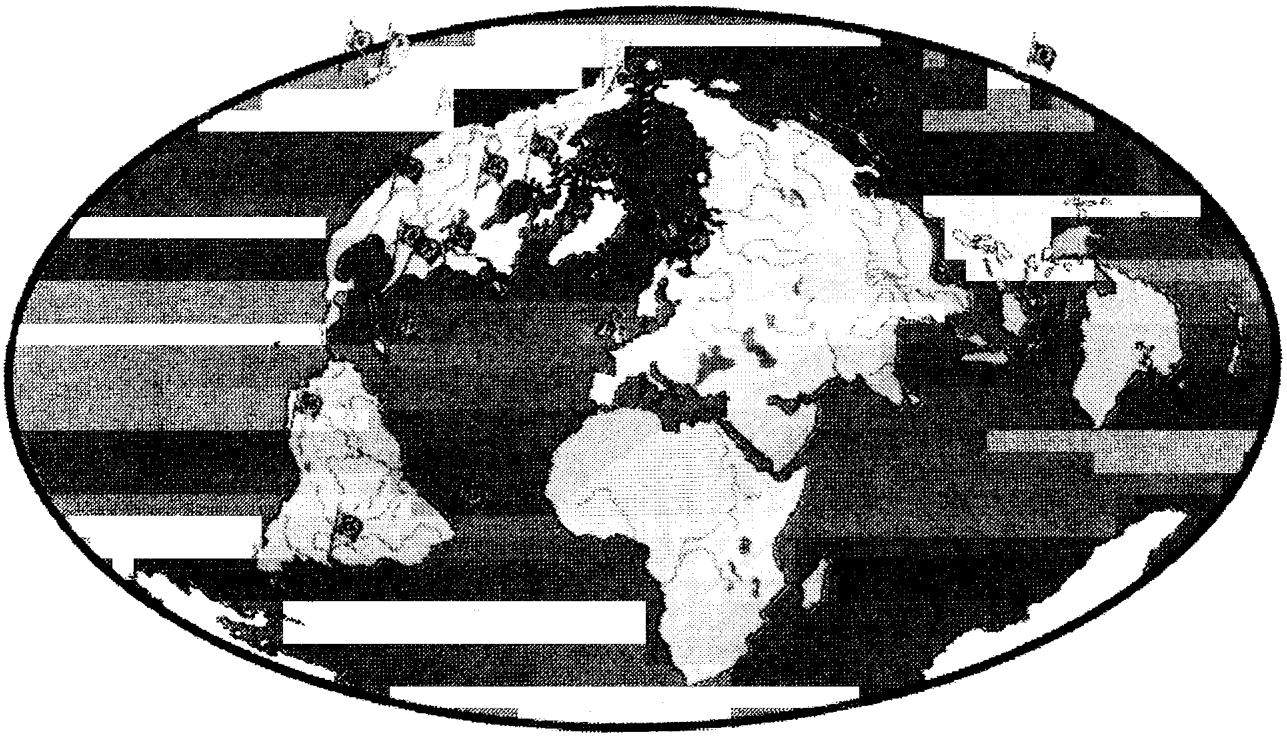
A HISTORY

Utah State University began atmospheric research three decades ago, in 1959, with the formation of Electro-Dynamics Laboratories. Research programs have grown continuously since that time, fostering a strong synergism between engineering and science. The major mileposts associated with this growth and development are illustrated in the figure below. Today's Space Dynamics Laboratory is the successor to these earlier laboratories and incorporates 40 years of experience in experimentation and instrumentation for upper atmospheric and space measurements. The related programs reach back to the earliest U.S. space experiments utilizing V-2 rockets. Space Dynamics Laboratory is the result of these merging research groups and continuing efforts to seek out and employ highly experienced and qualified researchers. The Center for Atmospheric and Space Science (CASS) complements the scientific research at Space Dynamics Laboratory



Rocket Launch Sites

Employed by Utah State University to Date



1. ya, Norway
2. Barking Sands, Hawaii
3. Eglin AFB, Florida
4. Ft. Churchill, Manitoba
5. Ft. Wainwright, Alaska
6. Johnson Atol
7. Kennedy Space Center, Florida
8. Kiruna, Sweden
9. Kwadjalein atol
10. Lima, Peru
11. Little Carter Cay, Bahamas
12. Natal, Brazil
13. Poker Flat, Alaska
14. Red Lake, Ontario
15. Rio Grande, Brazil
16. Sanriku, Japan
17. Sondestrom, Greenland
18. Thule, Greenland
19. Vanderburg AFB, California
20. Wallops Island, Virginia
21. White Sands, New Mexico

ROCKETBORNE INSTRUMENTATION

Total Rocket Payloads to Date	367

ROCKET PAYLOADS SINCE 1970

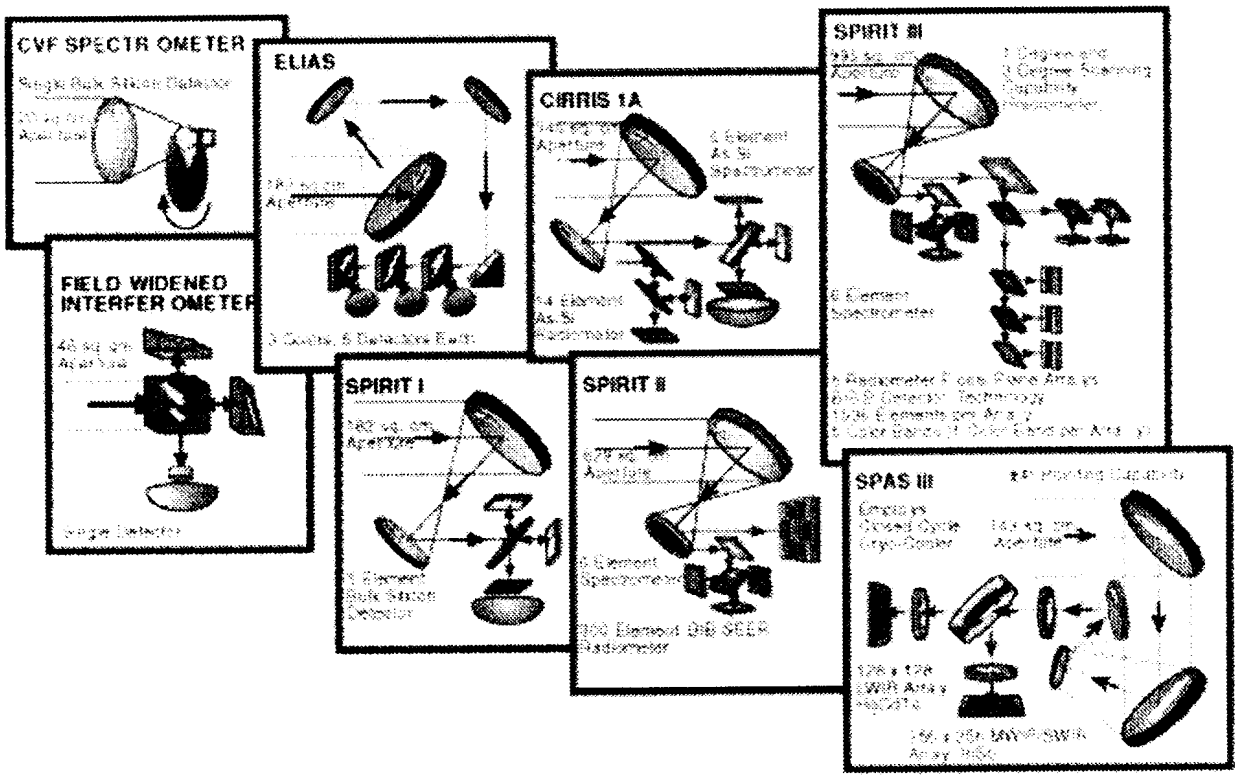
Total Payloads	183
Cryogenic IR Instruments Flown	77
Payloads Greater than 30" Diameter	11

EVOLUTIONS of CRYOGENIC INSTRUMENTS

at

Utah State University

1970 - 1997



INFRARED INSTRUMENT DEVELOPMENT

USU researchers made the first measurements of enhanced CO2 and NO emissions from aurora during the 1970s. The instruments designed to accomplish these measurements utilized single, bulk silicon detectors. Since that time, SDL/USU's infrared measurements programs have been propelled forward by the urgent need to characterize infrared emissions in greater spatial and spectral detail. Many of the instruments used to measure infrared radiation sources use either liquid nitrogen or liquid helium cryogens to reach the extremely low temperatures required, thereby attaining the necessary conditions for state-of the-art sensitivity. The SPIRIT III experiment features thousands of sensors in the focal planes and solid hydrogen as the cryogen.

Why Use The ULDB?

Ideal Platform for Geostationary Sensor Development

a. Slow moving footprint
b. Long-term testing
c. Continuous data stream processing
d. Similar thermal and data constraints

Slow moving, Above the Cloud Whole Sky Imaging

a. Gravity waves formed by tropospheric weather features,
b. These features obscure ground-based observations of upper-atmospheric waves
c. Long-term observations required to correlate wave structure and motion with disturbance structures

WHAT IS THE A^3M?
ALL ALTITUDE ATMOSPHERIC MONITOR

A combined Measurement and Development Program for:

a. Upper Atmosphere Stirring by Gravity Waves
b. Geosyncronous Imaging Sounder Development Platform
c. A Circumnavigational Atmospheric Measurement Program

Up Looking

Gravity Wave Imager

at Altitude

Rotation Stabilizer
GPS Location -Altitude
Pressure, Temperature

Down Looking

Advanced Geosynchronous
Thermal Sounder -
(Hyperspectral Imager)

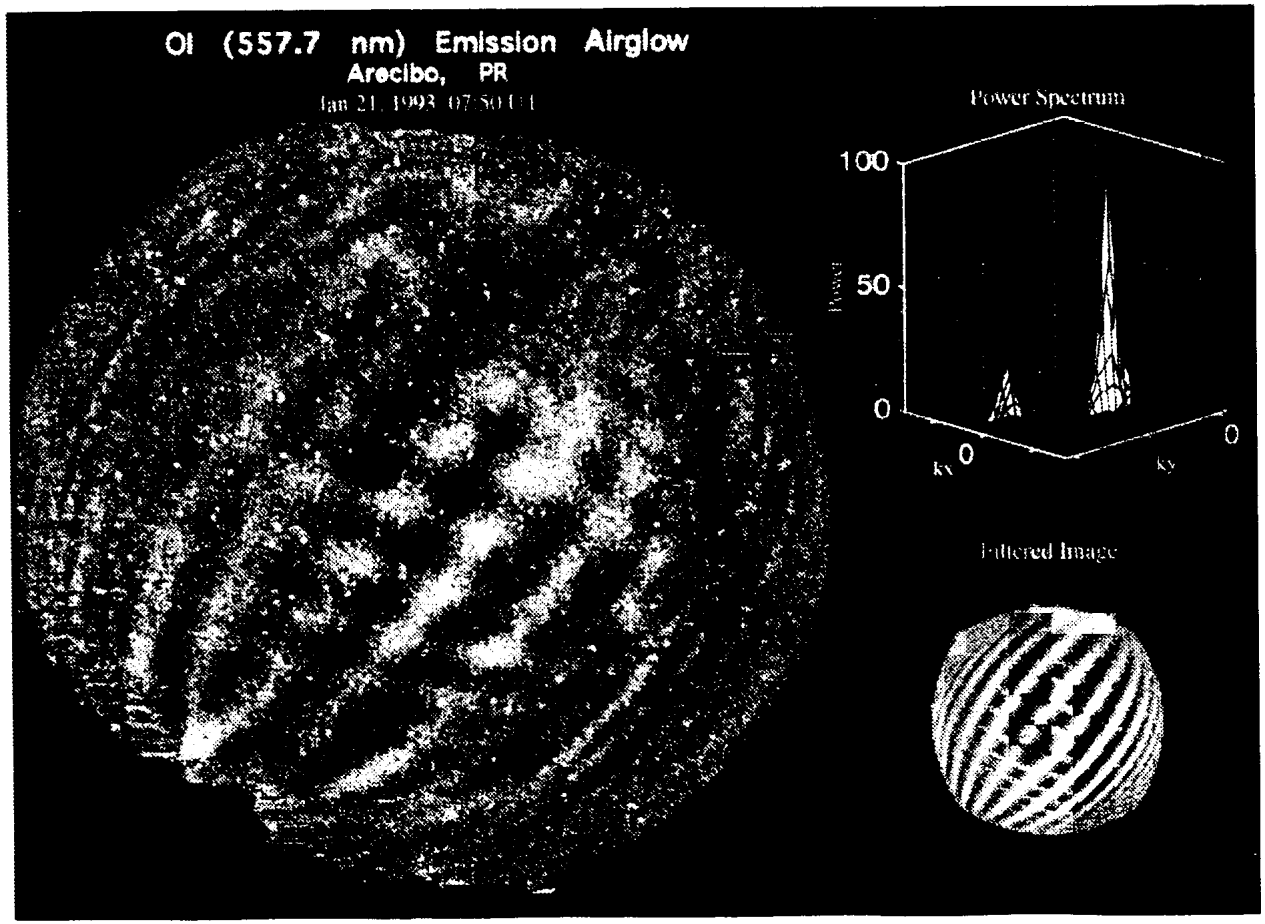
GRAVITY WAVE IMAGER

Purpose: To measure stratospheric circulation caused by gravity waves, using emission layer images.

Measurement Technique: All sky digital camera with emission layer filters.

Balloon Advantage: Gravity waves are generated by tropospheric disturbances such as large thunderstorms. The presence of these features in the troposphere make observing the resulting gravity waves from the ground very difficult.

Examples from ground based observations on two of the prominent emission layers follow.


OI (557.7 nm) Emission Airglow
Arecibo, PR
Power Spectrum
100
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0
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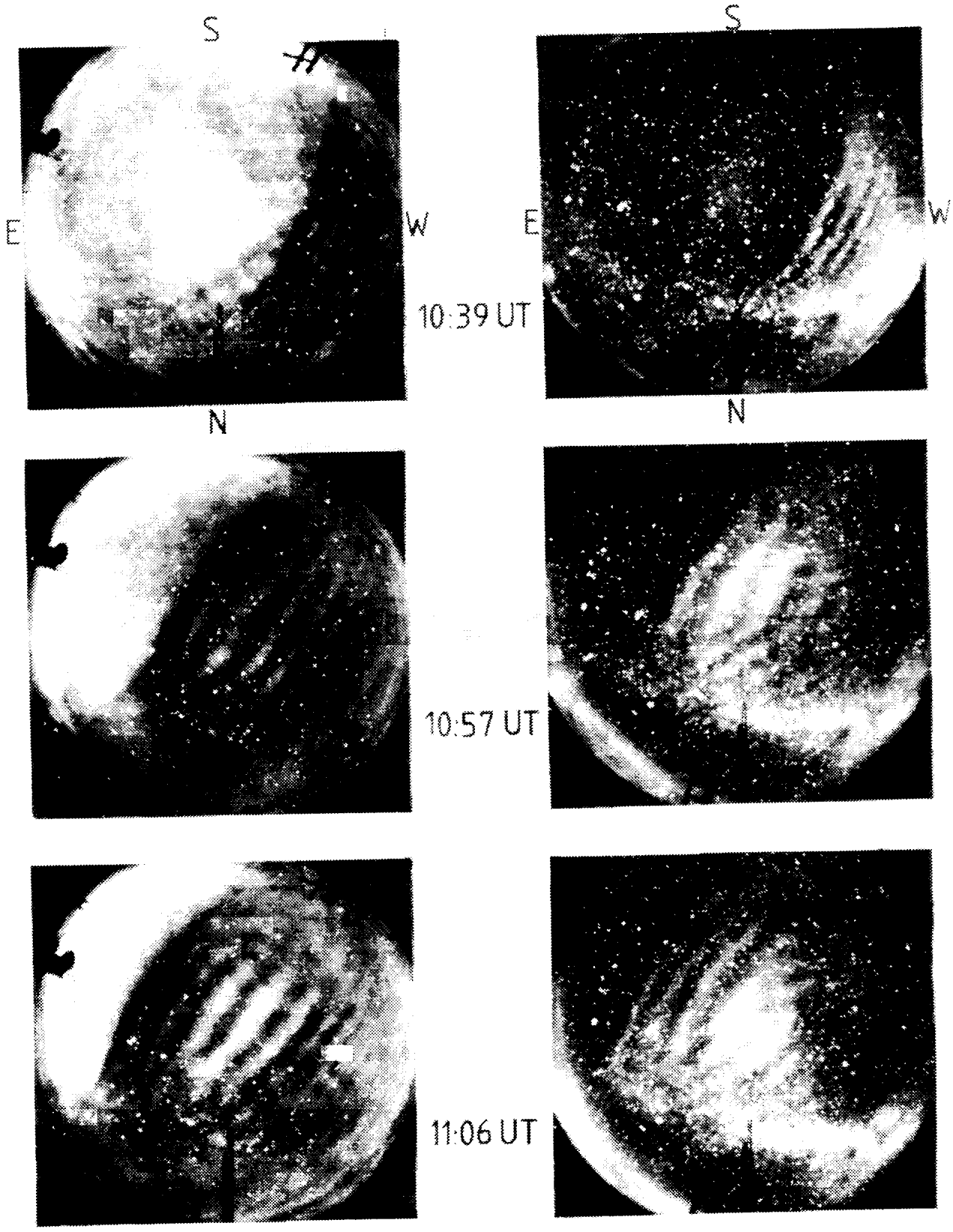
Filtered Image


S
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11:06 UT
OI(557.7 nm)
NIR OH

The Geostationary Atmospheric Sounder (GAS)

Objectives:

a. Measure distribution and transport of water vapor and other radiatively active trace gases

b. Measure thermal and radiative properties of the Earth's atmosphere, surface, and clouds

Measurement Characteristics:

a. Spectral coverage: 3.8 - 10μm (1000 - 2600 cm^{-1})

b. Spectral resolution: Variable, from 5 to 0.1 cm^{-1}

c. Spatial resolution: Selectable, 3 to 9 km